A new systematic determination of fission barriers with the HFB model

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Under certain hydrodynamical conditions, the r-process of nucleosynthesis may produce very neutron-rich fissioning nuclei for which no experimental data are known. Fission barriers and rates are therefore important inputs for the r-process, especially concerning superheavy nuclei up to the N=184 magic number. So far, extended tables of fission barriers have been constructed in the microscopic-macroscopic framework of the droplet model, and in the Extended Thomas-Fermi plus Strutinsky Integral (ETFSI) method. The ETFSI method is an approximation to the Hartree-Fock method and includes pairing using the BCS equations. It is however known that pairing correlations and shell effects play a crucial role in exotic nuclei produced by the r-process, for which a more microscopic model may be more appropriate.

We compare experimentally known fission barriers with those calculated using the constrained Skyrme-Hartree-Fock (SHF) method in a 3-dimensional deformation space. The pairing is included either in the BCS approximation or in the Bogoliubov plus particle number projection scheme. Different Skyrme forces fitted to all available nuclear masses given by the Audi and Wapstra compilation are considered. The energy surfaces are analysed using the flooding method, a necessary tool if more than two dimensions are spanned.

The accuracy and reliability of a large-scale SHF fission-barrier calculation, i.e. for about 2000 nuclei of astrophysical interest, is discussed.

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